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ABSTRACT

Children in kindergarten and grades 2, 4, and 7, and a group of adults were asked to choose, from a series of paired pictures, which of each pair represented the situation described in a statement that contained an ambiguous negation. In all five sentence types represented, there was a gradual progression toward adult performance, but approximation of adult performance peaked at different ages. The forms "Some of the rabbits aren't in their cages" and "None of the rabbits are in their cages" peaked at grade 4, and the form "Not all of the rabbits are in their cages" at grade 7. The most striking result occurred in the category of quantifier negation ("All the rabbits aren't in their cages," read with the emphasis on "all"). Despite the tendency of children to pick up on intonation as an early grammatical device, this category produced by far the highest "error" rate: only 38% adult norm responses at K level, in a pattern that persists through grade 7. This type of sentence thus appears to repair with intonation a contradiction between the surface marker and the underlying scope of the negation, and the acquisition of this syntactic structure appears to be put off until a relatively late age. (JB)

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THE DEVELOPMENT OF SOME ASPECTS OF QUANTIFIER NEGATION IN CHILDREN*

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Sentences like All the rabbits aren't in their cages have two possible interpretations for adult English speakers. What Carden (1970, 1973) has dubbed the 'Neg-Q' interpretation has the scope of negation on the quantifier all: [NEG all the rabbits] [are in their cages]. The 'Neg-V' interpretation, on the other hand, has negative scope on the verb or predicate: [all the rabbits] [NEG are in their cages]. Put more simply, this sentence can mean either that some of the rabbits are in the cages and some are not, or that not a single rabbit is in its cage. Carden has attempted to explain the distribution of these 2 interpretations in terms of so-called 'quantifier dialects', i.e. some speakers favor the Neg-Q interpretation whereas others favor Neg-V. Labov (1972:193-99) has countered that quantifier dialects are merely artifacts of the fragile nature and manipulability of linguistic intuitions rather than being a true characterization of linguistic variation. Both Carden and Labov (and others) have somewhat obscured the issues by not taking serious account of the characteristic intonation patterns associated with this type of syntactic construction. Carden (1973:178) makes brief vague reference to "stress and intonation patterns known to enforce one reading or the other", but the matter is very remote from his basic arguments. A notable exception to this tendency to overlook intonation in these matters is Liberman and Sag (1974), who not only correctly characterize the role of intonation in this type of structure, but even provide an interesting explanation for it. In any case, the facts regarding intonation include the following. There is a characteristic intonation pattern for this syntactic construction which yields virtually unambiguous Neg-Q interpretations in adults: high-rising pitch on the (stressed) quantifier, then falling to level, and

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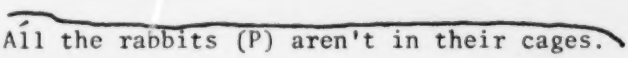
often rising at sentence end: e.g.:

All the rabbits aren't in their cages.

We'll refer to this sentence type as the 'Q' type. There are some variations on this basic pattern, but the defining variable seems to be the high pitch rise and concomitant vowel lengthening on the quantifier. Neg-V intonations with this construction are less common in normal speech settings but they do exist, even though they tend to be more ambiguous than the characteristic Neg-Q pattern. Typically, Neg-V interpretation can be elicited from most adults by a deliberate monotone, enhanced considerably by a pause after the subject NP; e.g.:



All the rabbits (P) aren't in their cages.

We'll refer to this sentence type as the 'V' type.

Now consider what the child faces in the acquisition of quantifier negation as it occurs in this type of construction in terms of what Slobin (1973) has called universal 'operating principles'--strategies that children seem to use in confronting the task of first language acquisition. In Slobin's discussion of the tendency for children to preserve underlying structures by doing such things as avoiding interruption or rearrangement of linguistic units (199), he isolates a principle which can be stated in various ways. E.g.: KEEP THE GAP BETWEEN SURFACE AND UNDERLYING STRUCTURES AS NARROW AS POSSIBLE. Or: INTERPRET SURFACE STRUCTURES AS IF THEY WERE ONLY MINIMALLY REMOTE FROM UNDERLYING STRUCTURES. Or even--and this is our own preference: TREAT SURFACE STRUCTURES AS IF THEY WERE MORE RELIABLE INDICES TO UNDERLYING STRUCTURES THAN THEY ARE (for adults). Of course, the syntax of natural languages doesn't always cooperate with acquisition strategies and the one just cited is certainly no exception. E.g. 'tough movement' in English creates a rather radical gap between surface and underlying structure and thus ought to be tough for young children to handle. E.g., in the sentence John is easy to see, the surface main subject John is not the underlying subject of is easy but the object of the subordinate verb see, and see(ing) John is in fact the underlying subject of is easy. Chomsky (1969) and Cromer (1970) have demonstrated that children do in fact display a tendency to misinterpret such structures--even as late as 7-8 years old.

The same operating principle would predict that the young child would have difficulty with our type Q sentences because of the considerable gap between their surface and underlying structures. Specifically, that gap is the result of the superficial negation of the VP even though the underlying semantic scope of negation is a quantifier, which can be quite remote sequentially

from its negator. The adult can interpret such a syntactic structure as Neg-V, but only given the less common V-type intonation. If the young child, on the other hand, were to insist on a better surface to underlying matchup, he would rule out the Neg-Q interpretation in favor of the Neg-V one, i.e. the surface VP negation would force a Neg-V interpretation and block the possibility of the negative having the quantifier in its scope. Of course this could persist only temporarily, since any such uncooperative syntactic constructions must ultimately wear down acquisition strategies as the child's speech approaches the adult's and he ultimately learns, in this case, that the surface negation of the VP really does have the quantifier in its scope.

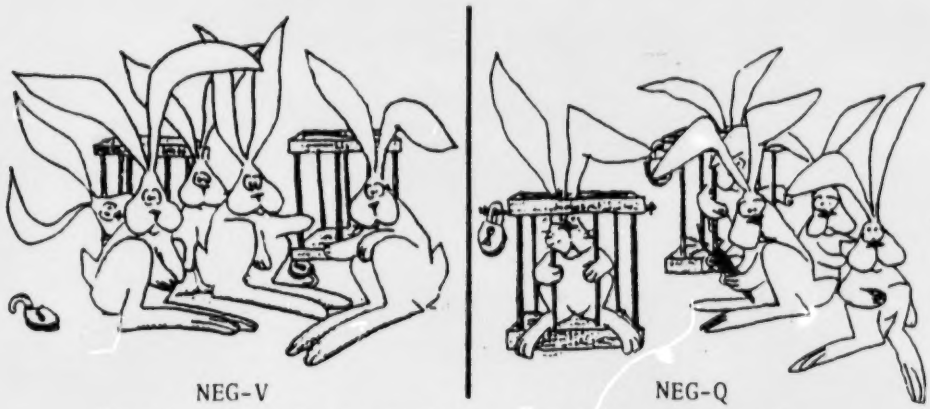
In an earlier study, Iannucci (1978) claimed that 3 to 4 year old children were dogged adherents to Neg-V interpretations of such sentences--no matter what the intonation--and that even 6 yr. olds were only beginning to show signs of change toward the adult model. Note further that the failure of children to pick up on intonation as a clear marking of Neg-Q interpretations (as it is for adults) is no trivial matter, since we know that children normally latch onto intonation at the very earliest stages of grammatical development. The earlier study, however, was informal, not particularly rigorous in design, and quite limited in scope. The study reported here was designed to remedy these shortcomings and to focus on the transition in interpretations of the sentence types we are concerned with from roughly age 5 to 13. In addition to the target syntactic construction with both Neg-Q and Neg-V intonations (types Q and V), three related sentence types were included as controls: types 'S' and 'N', where the underlying concepts are encoded in single lexical items (none and some), and type 'NA' where the Neg-Q concept is encoded by a simple syntactic juxtaposition of negative element and quantifier (not + all). Figure 1 summarizes the 5 sentence types.

Figure 1. Sentence types.

ADULT NORM:	TYPES:	E.G.:
(Neg-Q)	Q	All the rabbits aren't in their cages.
(Neg-V)	V	All the rabbits (P) aren't in their cages.
(Neg-Q)	S	Some of the rabbits aren't in their cages.
(Neg-V)	N	None of the rabbits are in their cages.
(Neg-Q)	NA	Not all the rabbits are in their cages.

Our method was as follows. There were 5 groups of subjects, varying from 15-22 per group: grades K,2,4, and 7 and an adult group. Three brief and entertaining stories were constructed and read to the K,2 and 4 groups (individually). They were told that they were helping us to make-up a story book by selecting pictures to go with the stories. We interrupted each of the three stories at 5 different points and asked each child to select one of 2 pictures that he thought best fit what had just been said at that point in the story. What had just been said was repeated when the pictures were displayed, and in every case was an example of one of our five sentence types. The picture choices were designed to

Figure 2. Sample picture choice.



NEG-V NEG-Q

"All the rabbits aren't in their cages" (etc.)

reflect the child's understanding of the sentences, and Figure 2 provides a sample. The originals are of course clearer and in color. Before the children were run through the 3 stories, a brief warmup session was held--using materials similar to those in the stories--in which we checked each child's understanding of the task and re-explained and practiced the procedure to the extent it seemed necessary. This turned out to be particularly useful with the K group.

Five versions of each story were constructed such that the five different sentence types were counterbalanced across story versions, with equal numbers of subjects hearing each version. The points of interruption and the picture choices were constant. Since this task was a decidedly juvenile one, we altered it somewhat for the Gr 7 and adult groups: we had them listen to tapes that had been made of the younger children being read to, explained that we had been studying younger children's understanding of

certain kinds of materials, and asked them to make the same picture choices while listening to the taped stories, as a basis for comparison. Needless to say, it is a considerable task to construct a method that is easy enough for a K group to handle, interesting enough for older children, and believable enough for older children and adults; and our solution is not without flaws, as we will see below.

The results are summarized in Figure 3. The entries represent the mean percentages of responses which matched our initial assumptions about adult norms--those assumptions are shown in parens at the left of Figure 1. Consider first our major interpretive problem: there is strong evidence, we believe, for a nuisance variable distorting the results somewhat for the Grs K and 2 groups. Specifically, some of the children in these 2 groups occasionally lapsed into an all-Neg-V strategy across whole stories--no matter what the sentence type--thus always picking the picture representing a uniform action or state (e.g. all the rabbits being outside of the cages) rather than the Neg-Q picture where the event is conceptually 'split' (e.g. some of the rabbits in cages and others out). Note that this bias has a tendency to inflate %s on the V and N types (cols. 2 & 4) but deflate %s on the Q S and NA types (cols. 1,3,5). In terms of developmental progress in the understanding of these structures, the V and N types then show falsely accelerayed rates of progress and the others decelerated rates, for the 2 youngest groups only. We attempted to come up with a principled procedure to eliminate subjects who seemed to fall into this pattern, tried several criteria which we ultimately decided were not feasible, and finally settled on leaving the data as-is and suffering the consequences. In any case, perusal of individual subjects' data sheets and the various criteria we tried to tease out guilty parties clearly reveal that the effect is worst in the K group, a good deal less in the Gr 2 group and non-existent elsewhere. For example, a criterion based on success in the S type (an easy type which would be defeated by an all Neg-V bias) would have eliminated 10/22 Ks, 3/19 Gr 2s and no Gr 4s.

Figure 3. % of responses matching assumptions about adult norms.

TYPES: / GRADES:	Q	V	S	N	NA
K	38%	73%	62%	86%	55%
2	47%	81%	81%	98%	79%
4	46%	83%	100%	100%	83%
7	58%	82%	100%	100%	100%
adult	96%	82%	100%	100%	100%

With the above in mind, then, consider some generalizations which we believe can be reasonably made about these results. The adult group results clearly corroborate our assumptions about adult norms: the S N and NA types yield categorically unambiguous interpretations; the characteristic Neg-Q intonation of the Q type leads to almost categorical (96%) results; the Neg-V intonation of the V type is largely successful (82%) but still leaves room for a certain amount of ambiguity.

In all 5 sentence types, there is a gradual developmental progression toward adult performance, although in some cases very slight and in one case non-existent (i.e. the change from Gr 2 to Gr 4 on the Q type, which we can't explain). Note also that the development of approximation of adult performance on the five different types peaks at different age levels. The S and N types peak (hit 100%) at the Gr 4 level--ostensibly the N type peaks at Gr 2 (98%), but remember that we believe this to be a category inflated by the earlier mentioned nuisance variable. That these two types would be easily mastered by children is no surprise since, as noted earlier, the underlying concepts are encoded in single lexical items. The NA type peaks at the adult norm (again 100%) slightly later--at Gr 7--possibly because encoding a concept by means of syntactic juxtaposition of lexical items is somewhat more complex than purely lexical encoding. Interpretation of the V type results has to be handled somewhat differently. As with the N type, the Gr 2 results are probably inflated, thus only ostensibly hitting the adult peak. Also, the adult norm is significantly below 100%, thus automatically narrowing the gap between child and adult comprehension. In fact, it may well be that type V development is much more on a par with NA development than is apparent from a literal reading of the data. Note, e.g., that at the Gr 4 level, which we believe to be free of the nuisance effect, the % of 'correct' responses for the V and NA types is identical at 83%. Note further that these two types share an important structural similarity: the superficial syntactic juxtaposition of their negative elements matches the underlying scope of negation: surface not all means Neg-Q and surface not VP means Neg-V.

Finally, note that the most striking results occur precisely in the category which is the focus of this study--the Q type. Despite the fact that children tend to pick up on intonation as an early grammatical device in general, and that the disambiguating effect of intonation in this category is virtually total for adults, this category produces the by-far highest 'error' rate of the study--only 38% Neg-Q responses at the K level; and this pattern, although gradually weakening, persists even through Gr 7 In no other sentence type do the children fail to reach the adult norm, and furthermore the difference between Gr 7 and adults in this type (58% vs 96%) is the largest one elicited between adjacent groups. The Gr 7 group are the only ones who perfectly match adult performance on all 4 of the other categories, but they still lag far behind adults on the one type which requires violation of our

operating principle. The Q type sentence, then, appears to be a particularly adult syntactic/intonational structure: one where the surface marking of negation, in effect, misrepresents the underlying scope of negation--a matter that the adult speaker arbitrarily patches up by means of a characteristic intonation pattern. To complicate matters further, another intonation pattern--but a less common one--does allow the surface-to-underlying relationship of negation to match (unlike, for example, the tough-movement structures mentioned earlier where the surface-to-underlying relations are always mismatched). Thus our Q type sentence is a natural candidate for running afoul of the operating principle under discussion here, one that still seems to be functioning at quite a late stage of language development.

Finally, it is certainly the case that we can continue to maintain, in general, that the great bulk of a grammatical system is mastered by age 5 or so, but it also strikes us that more research is needed to clarify the details of late refinements in the grammatical system, some of which may be affected by operating principles that are surprisingly persistent.

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